Rewarding Science in Ancient Greece and Rome

Serafina Cuomo
Durham University
serafina.cuomo@durham.ac.uk

Abstract

This paper surveys some of the ancient Greek and Roman evidence regarding rewards for science and scientists. It discusses Platonist views on whether science ought to be its own reward, and possible alternatives to such views. It concludes that a variety of attitudes existed on the issue in antiquity, and that they can be understood in terms of the social and economic status of ancient science practitioners.

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One of the most famous stories about science and rewards circulating in antiquity, is the anecdote of Euclid and the obol:

> Someone who had started to do geometry with Euclid, as he learned the first theorem, asked Euclid: "What shall I gain learning these things?" And Euclid having called a slave said: "Give him three obols, because he needs to profit from these things."[1]

Notice that the inept learner's question is open-ended as to what might count as 'benefit' — he may have meant benefits other than money, but Euclid's answer is very specifically about *kerdos*, profit, which here is both negative and monetary, what

[1] Stobaeus, *Florilegium* II 228.25-9 (ed. Wachsmuth), fifth century CE, my translation. Cf. Michalis Sialaros, "How Much Does a Theorem Cost?," in *Revolutions and Continuity in Greek Mathematics*, edited by Michalis Sialaros (Berlin: de Gruyter, 2018), pp. 89-106.

in Italian would be referred to as “il vile denaro.” *Kerdos* suggests the neglect or even crossing of ethical rules in the pursuit of profit. It is also to be noted that, not accidentally, the protagonist of the story is a mathematician, whose fame is linked to a work with no immediately apparent practical applications, and which needs to be studied carefully and systematically, as is hinted here.

This famous anecdote is almost certainly spurious, but also a good example of an idea which enjoyed widespread currency in ancient Greece and Rome, namely that science ought to be its own reward. In this paper I take ancient ‘science’ to map onto the domain both of *episteme*/*scientia*, and of *techne*/*ars*. This not only allows us to include medicine and architecture alongside mathematics and natural philosophy, but it also acknowledges the contested nature of knowledge at the time. While I am aware that other types of reward were available, in this paper I concentrate on financial rewards, or those leading to financial benefit. Finally, I draw on evidence both Greek and Roman, with some disregard for chronology, but that is partly justified by the fact that there were diachronic, trans-cultural trends, as I hope to demonstrate.

Euclid is not the only ancient hero of knowledge for the sake of knowledge — we also have, famously, Plutarch’s Archimedes, who spurned any kind of concrete benefit stemming from his research, and could lose himself completely in his diagrams,[2] or, on the Roman side, Pliny the Elder, who not only died in the pursuit of science, but talked at length about the horrors visited on the environment by the quest for profit.[3] As an active member of the elite, Pliny knew quite well the problem, also discussed by Cicero, particularly in *De officiis*, of reconciling the love of knowledge with the demands of a busy life.

[2] Plutarch, *Life of Marcellus* 14.3-4, 17.3-4, 6. Cf. Mary Jaeger, *Archimedes and the Roman Imagination* (Ann Arbor: University of Michigan Press, 2008).
[3] Pliny the Elder, *Natural History* e.g. 33.1, 36.1. Cf. Eugenia Lao, “Luxury and the Creation of a Good Consumer,” in *Pliny the Elder: Themes and Contexts*, edited by Roy K. Gibson, Ruth Morello (Leiden: Brill, 2011), pp. 35-56.

Ancient sources, however, do not just celebrate the heroes and martyrs of science. We also have a well-established villain, in the person who sells his knowledge for money — despite modern rehabilitations, think for instance of the Sophists in Plato or in Aristophanes, whose *Clouds* typically subverts roles and values by not only casting Socrates as morally ambiguous at least, but also by having characters subtly undermine the ideals of the Athenian elite:

> STREPSIADES: That is the thinking house of sapient souls. There dwell the men who teach — aye, who persuade us, that heaven is one vast fire-extinguisher placed round about us, and that we're the cinders. And they'll teach (only, they'll want some money) how one may speak and conquer, right or wrong.
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> PHIDIPPIDES: Come, tell their names.
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> STREPSIADES: Well, I can't quite remember, but they're deep thinkers, and true gentlemen.[4]

The emphasis in this brief exchange is not only on the silver involved in the transaction, but also on the fact that the sophists were, notoriously, uninterested in right or wrong, as long as they could win an argument. The education they provided for a fee made a mockery of the ideal of the "good and beautiful" (καλοί τε κἀγαθοί, here translated "true gentlemen"), or, in later parlance, the "liberally educated" (πεπαδεῦμενοι), upheld by many of the extant Greek and later Roman authors. Thus,

[4] Aristophanes, *Clouds* 94-102 (tr. Loeb). The literature on this theme in Aristophanes is vast; see e.g. Carlo F. Russo, *Aristofane, autore di teatro* (Firenze: Sansoni, 1992[2]), pp. 178-179; Michele Stanco, "Il filosofo tra le nuvole: la figura di Socrate in Aristofane e nell'intertesto contemporaneo," in *Comparatistica e intertestualità. Studi in onore di Franco Marenco*, edited by Giuseppe Sertoli, Carla Vaglio Marengo, Chiara Lombardi, vol. 1 (Alessandria: Edizioni Dell'Orso, 2010), pp. 73-80 [*non vidi*].

many more examples could be cited, but the gist is that knowledge is an absolute value, that should be pursued for itself, not for the advantages it may bring. In this worldview, rewards are extraneous, epiphenomenal, a dangerous distraction, a means of corruption.

If all this sounds vaguely Platonic, that's because it is — in the *Republic*, for instance, we find as a recurrent theme the idea that pursuing true knowledge is immensely rewarding, to the point of obliterating the desire or inclination to engage in more worldy affairs. When describing what happens when the men who have been freed out of the cave and seen the sun and the world as it truly is, are asked to return to the cave, to their fellow prisoners, Socrates says:

> "If they had any honours among them there, any accolades and rewards for anyone who could see the passing images most distinctly and could best recall which of them came first, which came last, and which came along together, and as a result of this was best at predicting what would come next, would you think he would long for them and envy those people among them who were honoured and exercised power, or would he experience what Homer says and eagerly wish 'to be slave tending a field for someone else, a person of no renown' and undergo anything rather than what he thought about down there and live in the way he did down there?"
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> "I think that's true," he [Glaucon] said. "He would agree to undergo everything rather than live as they do down there." […]
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> "[D]on't be surprised that those who go there are not willing to engage in human affairs, but their souls constantly hurry upward to spend their time up

there, and that is what we would surely expect, if the image we have talked about is right in this aspect too."[5]

This dilemma is basically the inspiration for Cicero's *De officiis*: how can one both be a true philosopher, and live in the real world? How can the pursuit of truth be reconciled with daily necessities? In book 7 of the *Republic*, the guardians' education is knowledge with a purpose (that of ruling the city), but at the same time it is so disconnected from the idea of reward that, in the myth of the cave, the people who have achieved true knowledge and are thus forced to return to the cave (or rule the city), suffer what is seen as a punishment, in that they are not free to spend their entire time 'looking upwards,' because they remain enmeshed in wordly realities. In other words, far from being rewarded, true knowledge is marked by deprivation and loss.

The Homeric words that Socrates is quoting in the Platonic passage are from the episode in the *Odyssey* where Odysseus meets a very changed Achilles in the underworld,[6] and is perhaps a somber reflection on things other than science, which were generally seen as goods in themselves at the time. For instance, glory in battle or dying for the father- or motherland, such as we find, for instance, in Pericles' funeral speech in Thucycides, which highlights the trifecta of freedom, power and education: Athens is powerful and free — powerful because she is free — and she is also the school of Hellas.[7] Or again, victory at the Olympic games, which was rewarded, in principle, simply with an olive branch. Athletics and war were connected in many ways; it is perhaps here that we should seek the roots of the image of the scientist as

[5] Plato, *Republic* 516c-d, 517c-d (tr. Loeb).
[6] Homer, *Odyssey* 11.489-90 (tr. Loeb): "Nay, seek not to speak soothingly to me of death, glorious Odysseus. I should choose, so I might live on earth, to serve as the hireling of another, of some portionless man whose livelihood was but small, rather than to be lord over all the dead that have perished."
[7] Thucydides, *The Peloponnesian War* 2.40.5-41.1.

an athlete of the mind, as a fighter (think of the war against disease), or, as its flipside, the image of the 'mercenary' scientist. By putting knowledge ahead of other things which may have been seen as their own reward, Plato operated a revolutionary shift.

By the early imperial period the idea of an education proper for the ideal citizen (the Greek *paideia*) had received influential articulation in the writings of, among others, Seneca:

> You have been wishing to know my views with regard to liberal studies. My answer is this: I respect no study, and deem no study good, which results in money-making. Such studies are profit-bringing occupations, useful only in so far as they give the mind a preparation and do not engage it permanently. One should linger upon them only so long as the mind can occupy itself with nothing greater; they are our apprenticeship, not our real work. Hence you see why 'liberal studies' are so called; it is because they are studies worthy of a free-born gentleman. But there is only one really liberal study, — that which gives a man his liberty. It is the study of wisdom, and that is lofty, brave, and great-souled. All other studies are puny and puerile.[8]

Seneca goes on to emphasize the moral shallowness of sciences like arithmetic and geometry, when taken by themselves or aimed at practical activities such as measuring land, rather than as ancillary to philosophy. Intrinsic to the very term 'liberal studies,' is a complete identification between the type of knowledge someone possesses, and the quality or status of that person. Knowledge must be independent

[8] Seneca, *Letters to Lucilius* 88.1-2 (tr. Loeb).

and self-sufficient: it must be free. If knowledge comes with a reward or, *horribile dictu*, a wage, then it is no longer free, but slavish, because it depends on another.

While we may not share all of Seneca's reference points, his ideal of knowledge unimpeded by mundane considerations still resonates today. Think for instance, at least in the UK, of the conflict between the measurable impact required by the REF (governmental research assessment), and so-called blue-skies research, or of the ambiguity academic historians feel around media work, also known as 'selling out', or of having to relate to students as 'customers.' In other words, in our daily lives as beleaguered and hassled academics, the story of Euclid and the obol strikes a chord.

And yet, one might well ask: is a different reaction to the story possible? The fact that we see Euclid's student as someone who fundamentally 'doesn't get it,' indicates that, as academics, we have been socialized and trained into forming a community where the ideal of knowledge being its own reward is paramount. It is an ideal we have entirely internalized. And yet, we know from the history and sociology of science that the conflation of type of knowledge and type of knower is not innocent. It is a marginalizing move in a contest about science, but also about society.[9]

Thus, we need to step back and acknowledge that the ideal of disinterested science is a historical construction. Plato's vision stood in contrast to a reality where science — not necessarily of the 'right' kind — was indeed rewarded. The sophists were socially and financially successful; traders and bankers used their arithmetical skills for profit; doctors obtained civic honours,[10] privileges,[11] money and, through money, freedom:

[9] Steven Shapin, Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle and the Experimental Life* (Princeton: Princeton University Press, 1985).
[10] Vivian Nutton, "Archiatri and the Medical Profession in Antiquity," *Papers of the British School at Rome*, 1977, *45*:191-226 listed 93 inscriptions, papyri and coins from the Hellenistic period onwards, relating to *archiatri*. See more recently Évelyne Samama, *Les médicins dans le monde grec. Sources épigraphiques sur la naissance d'un corps medical* (Genève: Droz, 2003).

> Publius Decimius Eros Merula, freedman of Publius, clinical doctor, surgeon, oculist, member of the board of six. For his freedom he paid 50,000 sesterces. For his membership on the board of six he contributed to the community 2,000 sesterces. For the erection of statues in the temple of Hercules he gave 30,000 sesterces. For paving streets he contributed to the municipal treasury 37,000 sesterces. On the day before he died he left an estate of… sesterces.[12]

Specialist doctors could evidently be rewarded quite substantially, especially if their clients were members of the upper strata of society. Catapult builders, among whom we can count Archimedes himself, were often rewarded by kings themselves. The origin story for the catapult that we find in Diodorus revolves entirely around rewards. Not only does Dionysius of Syracuse gather "skilled workmen, commandeering them from the cities under his control and attracting them by high wages from Italy and Greece as well as Carthaginian territory"; he also keeps providing incentives, both financial and social, after gathering a critical mass of military technology experts in one place: "Dionysius circulated daily among the workers, conversed with them in kindly fashion, and rewarded the most zealous with gifts and invited them to his table."[13] Soon enough, the catapult had been invented, or so Diodorus claims.

There are interesting parallels between the Greek historian's perspective and that of a practitioner: Philo of Byzantium links another military technology discovery, this time that the diameter of the cylinder holding the torsion spring of a catapult is the module for the other parts of the catapult, also to the patronage of kings:

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[11] E.g. Democedes in Herodotus 3.133-7; Pliny the Younger's *iatraliptes* in his *Letters* 10.5.
[12] *CIL* XI 5400, found in Assisi (central Italy), possibly 1st century CE (tr. Lewis, Reinhold).
[13] Diodorus, *The Library of History* 14.41-42 (tr. Loeb). Cf. Serafina Cuomo, *Technology and Culture in Greek and Roman Antiquity* (Cambridge: Cambridge University Press, 2007), ch. 2.

> People later on, observing previous mistakes and from what had been experienced afterwards looking carefully for an established element, led to the basic principle and foundation of the construction, namely the diameter of the circle that holds the spring. Alexandrian technicians achieved this first, being heavily subsidized because they had kings who were lovers of fame and lovers of technology.[14]

In the practitioners' own descriptions, the rewards for knowledge often come in the form of honour and recognition in the community, with a comfortable financial position receding to the background — these scientists are moral heroes, but in ways that are subtly different from the heroes of disinterested science we saw earlier. A good example is Galen — he did not shy away from reporting on the rewards that his knowledge brought him,[15] even though in his encounters with members of the imperial family he seems to emphasize praise (and the envy of his rivals) as a reward, over the inevitable financial gains. In his *Protreptikos* he lists as 'good knowledge' a throng of disciplines which includes geometry, mathematics, medicine, astronomy, but also the more economically viable painting, sculpting, architecture and elementary teaching, and tackles quite explicitly the issue of money:

> [M]aking money by one's own efforts is not in itself admirable; it is only admirable if one has true understanding of an art — the kind of art which will "float with one in the case of a shipwreck." This is not something which

[14] Philo of Byzantium, *Construction of catapults* 50 (tr. Marsden), modified.
[15] E.g. Galen, *On Prognosis* 8.19-21, where he mentions both money and a connection to the emperor as consequence of healing a patient. Cf. Susan P. Mattern, *Galen and the Rhetoric of Healing* (Baltimore: Johns Hopkins University Press, 2008).

> belongs to those who manage other people's financial affairs, nor to tax-farmers or merchants. Such people get more money from their activities than anyone; but, if they lose their money, they are also unable to perform these activities […]. So, if what is required is a training that will lead to a secure livelihood which is at the same time honourable, the answer is a lifelong dedication to Art.[16]

Galen concludes by adding that the arts which are less labour-intensive are preferable — but because they can be practised into old age. The difference is not presented as a matter of lower status, or slavishness.

Galen's words about a shipwreck allude to a notion we also find in Vitruvius — that the most valuable possessions are those which would not be lost in a shipwreck, such as knowledge, particularly knowledge of the kind that enables the knower to make a living out of it. Indeed, Vitruvius displays an amazingly complex set of views about the rewards of science, in his case, architecture. He is both aware of the financial aspects of his profession, and willing to subordinate them to good reputation and morally correct conduct.[17] There has been some discussion as to what rewards Vitruvius hoped to reap by writing *De architectura*. Some say recognition as a literary author, some suggest that he may also have been interested in continuing to enjoy the patronage of the imperial family. Even Archimedes played the courtly game in addressing his short treatise *Sand-reckoner* to a king of Syracuse, using the rhetoric of

[16] Galen, *An Exhortation to Study the Arts* K37-38 (tr. Singer).
[17] E.g. Vitruvius, *On Architecture* 6. preface; 9. preface. Cf. Elisa Romano, *La capanna e il tempio: Vitruvio o dell'architettura* (Palermo: Palumbo, 1987); Antoinette Novara, *Auctor in bibliotheca. Essai sur les textes préfaciels de Vitruve et une philosophie latine du Livre* (Leuven: Peeters, 2005).

numbering multitudes and harnessing infinity, in a way that Reviel Netz has shown to chime in with contemporary Hellenistic poetry.[18]

To summarize, what we see is a discrepancy between the ideal of disinterested science, and the reality of mercenary, or at least patronage-friendly, science. This may have corresponded to asymmetries in social status. Those who could afford it, either members of the elite or recipients of patronage, practised disinterested science, whereas all the others, including the architect's son Galen, had to make a living and consequently represented their knowledge as more reward-friendly. This distinction would have created a further asymmetry between more 'theoretical' forms of knowledge, such as philosophy or advanced geometry, the preserve of the privileged few, and applied science, practised by the less privileged but shunned by the elite. There is a corollary assumption that the non-elite would naturally aspire to become elite, and therefore epistemically the exponents of 'applied' science would be expected to seek legitimacy by giving their discipline a literary and theoretical veneer.

And yet, such a simple binary mapping of social and epistemic status does not fit the evidence. Social and epistemical aspirations need to be evaluated more carefully — sharing in literate culture does not amount to endorsing or seeking legitimation from it. Arguably, scientific writers forged their own distinctive literary cultural identity. Secondly, and more importantly, this is not just a matter of different social perspectives. The very idea of science being its own reward originated, in my view, as a means to reinforce asymmetries in social status, and to appropriate the nexus between power and knowledge to some sectors of society over others. In other words, the idea of disinterested science, whose most influential articulation dates to fourth-century BCE Athens, is in essence an aristocratic idea, and an anti-democratic

[18] Reviel Netz, *Ludic Proof. Greek Mathematics and the Alexandrian Aesthetic* (Cambridge: Cambridge University Press, 2009).

idea. Its values are constructed so as to impede rewarding of expertise leading to social mobility. It is not so much that if you are rich you do not need rewards, *ergo* from your vantage point knowledge is its own reward — it is the idea that you should positively not *want* to be rewarded for knowledge, *ergo* only those who can do without a reward are seen as able fully to engage in the pursuit of knowledge.

This becomes especially clear if we, following Seneca's lead, bring slavery into the equation. Knowledgeable slaves are paradoxical to the nexus of power and knowledge because they have lots of knowledge, but in principle none of the power. The long episode in Petronius' *Satyricon* known as *Cena Trimalchionis* displays, among other things, the contrast between different types of knowledge and what rewards they have brought the protagonist (the freedman Trimalchio), his friends, also mostly ex-slaves, and their families. In the (reported) words of one of Trimalchio's guests to his child:

> Mark my words, Primigenius, whatever you learn, you learn for your own good. Look at Phileros, the barrister: if he had not worked, he would not be keeping the wolf from the door today. It is not so long since he used to carry things round on his back and sell them, and now he makes a brave show even against Norbanus. Yes, education is a treasure, and culture never dies.[19]

There is no doubt that the passage is satyrical, but once its subversive potential is activated, the satyre can cut both ways, depending on the public. One can laugh at the freedman's idea of education, but also laugh *with* him at the thought of how far he has come in the world, despite it all. Petronius exposes Trimalchio's lack of *paideia*, and

[19] Petronius, *Satyricon* 46 (tr. Loeb). Cf. Victoria Rimell, "Petronius' Encyclopedia: Neronian Lessons in Learning – The Hard Way," in *Ordering Knowledge in the Roman Empire*, edited by Jason König, Tim Whitmarsh (Cambridge: Cambridge University Press, 2007), pp. 108-132.

yet at the same time, he lays bare the fact that kinds of knowledge other than *paideia* might have made a dramatic difference in real life to the fortunes of former slaves. It is all very well to decree that the knowledge of a free man must be detached from profit, if you are a wealthy senator. The knowledge of Trimalchio and his friends (and of Eros Merula), by being illiberally profitable, and not without some luck, has made them free. They stand as heroes of knowledge, of yet another kind from what we have seen so far — a more adventurous and precarious kind.

In conclusion, the idea that science ought to be its own reward is part of the legacy of ancient Greece and Rome, contained in the same vaguely Platonist package as the idea of a liberal education. At the same time, we must be aware that, historically, the notion of disinterested science as opposed to mercenary knowledge, may have been formulated in order to uphold specific social and political hierarchies. Accordingly, it was contested. Knowledge can set you free, both because it can detach you from the prison of mundanity — the necessity of making money — and precisely because it makes you money, and brings you benefits of a tangible kind. The question we are left with is then, which part of that legacy should we espouse as our ideal, today?